

THURSDAY, FEBRUARY 9, 1905.

## SCIENTIFIC RESULTS OF THE BELGIAN ANTARCTIC EXPEDITION.

*Résultats du Voyage du S.Y. Belgica en 1897, 1898, 1899, sous le Commandement de A. de Gerlache de Gomery. Rapports scientifiques. (1) Zoology and Botany. (2) Astronomy and Meteorology.* (Antwerp, 1902-4.)

(1) THE cruise of the steam-yacht *Belgica*, organised by the Belgian Government, may be regarded as the first of the series of expeditions fitted out during the last few years to explore the Antarctic and to collect systematically its zoological and botanical products. Consequently, it fell to the lot of this expedition to be the first to bring back specimens of certain animals previously known, more or less imperfectly, by examples obtained by the early expeditions to the South Polar regions, such as that of the *Erebus* and *Terror*. The most noticeable instance of this is afforded by the seal known as *Ommatophoca rossi*, which had been previously known only by two skulls and a skin brought home by the *Erebus* and *Terror* Expedition (1839-43). Fortunately, the fasciculus of the *Rapports* dealing with the seals (by Captain Barrett-Hamilton) was published in 1902, and ante-dates the British Museum report on the *Southern Cross* Expedition, thereby securing to the *Belgica* the full credit for having been the first to increase our knowledge of this interesting species.

The comparative slowness of the rate at which it has been found practicable to issue the result of the *Belgica*'s work will, however, necessarily have discounted some of its claims to priority, seeing that the aforesaid report on the collections made by the *Southern Cross* was published in 1902, while at least one small instalment of the zoological results of the *Discovery* Expedition has already been made public. On the other hand, in many of the groups the new forms discovered by the *Belgica* expedition were described at an early date in the form of preliminary notices (in the case of the fishes as early as 1900), and as the later parts of the work before us contain reviews of the species described in the report of the *Southern Cross* Expedition, an advantage rather than a disadvantage has been gained by the delay in publication. This is particularly noticeable in the fasciculus devoted to fishes, which was published in 1904.

The characteristic of the reports on the *Belgica* collections is the wealth of detail with which the descriptions are worked out and the elaborate style in which they are issued. The entire work is, for instance, published in quarto form, in large type, with no apparent limitations to the extent of the letter-press, and a fair allowance of plates, most of which are admirably executed. Each section of the subject has been assigned to a specialist, and the mere mention of the fact that Captain Barrett-Hamilton is responsible for the seals, Mr. Racovitza (the

naturalist to the expedition) for the cetaceans, Mr. Dollo for the fishes, and Dr. Pelseneer for the greater part of the molluscs, will be a sufficient indication of the care and wisdom with which the selection of these specialists has been made.

A total of more than sixty separate memoirs on the zoology of the expedition is promised, and of these no less than fourteen (ranging in their subjects from seals and cetaceans to corals and sponges) are now on the table before us. Within the limits of the space at our disposal it would obviously be impossible to attempt anything like a summary—much less a criticism—of the vast amount of work contained in this mass of literature. All that can be essayed is to record a few of the more striking results of some of these investigations, and at the same time to express our opinion, so far as we are capable of forming a judgment, of the high value and importance of the work generally.

As regards Mammalia, perhaps the most important result of the *Belgica* Expedition was a negative one, namely, the practical demonstration that no large forms of terrestrial mammalian life inhabit Antarctica. In his first expedition Mr. Borchgrevink was, indeed, inclined to attribute certain marks commonly seen on the hides of the Antarctic seals to the teeth of a land carnivore, but it is now believed, with much more probability, that they are due to sharks. Mr. Racovitza, it may be added, was the first to make us acquainted with the peculiar gular pouch and strange cry of Ross's seal.

In treating of the cetaceans, Mr. Racovitza, who (like Captain Hamilton in the case of the seals) has no new species to describe, makes some very interesting remarks with regard to the mode of life and physiology of these animals. Especially important are those relating to the depths to which whales are capable of descending. These the author believes to have been exaggerated very greatly, and he puts the extreme limit at one hundred, and the ordinary range at twenty-five metres. As he well remarks, it is practically impossible to imagine an animal the organisation of which would admit of its existence alike at the surface and under the pressure of abyssal depths. His arguments are supported by certain facts in regard to the depths at which cetaceans are captured by the Japanese.

In the bulky fasciculus on the fishes Mr. Dollo has incorporated the results of Mr. Boulenger's work on those obtained during the *Southern Cross* Expedition, and has thus been enabled to present his readers with what is practically a monograph of the Antarctic forms. The most remarkable representatives of this fauna are those constituting the family Nototheniidæ, of which the author recognises no less than eighteen generic types, three of these being named by himself. Whether he is justified in proposing the name *Cryodraco antarcticus* for the fish which he apparently admits to be identical with the one captured during the voyage of the *Erebus* and *Terror* and named *Pageodes*, on account of the alleged insufficient definition of the latter, may be doubtful. In our opinion

the original sketch of *Pagetodes* is amply sufficient for the generic definition.

Very few words must, unfortunately, suffice for the parts devoted to invertebrates. In the fasciculus on brachiopods, Prof. Joubin directs attention to the apparently small bodily size of the Antarctic representatives of the group, a feature which is the more notable on account of the contrast they present in this respect to the forms from the Straits of Magellan. Another important fact in connection with the fauna of the southern ocean is brought out by Prof. Kochler in his description of the echinoderms obtained to the south of lat.  $69^{\circ}$ , the furthest point from which these organisms had at the time been obtained. Practically all these echinoderms have proved to be new forms, but whether they belong to the sub-Antarctic or the true Antarctic fauna has not yet been definitely ascertained.

The other fasciculi at present to hand include the following monographs:—molluscs, by Messrs. Pelseneer and Joubin; myriopods, by Mr. C. von Attems; collembola, by Mr. V. Willems; copepods, by Dr. W. Giesbrecht; nematodes, by Dr. J. G. de Man; nemertines, by Dr. O. Bürger; bryozoans, by Mr. A. W. Waters; hydroids, by Dr. C. Hartlaub; zoophytes, by Messrs. von Marenzeller and Carlgren; and sponges, by Mr. E. Topsent. The botanical memoirs include one by Dr. E. A. Wainio on lichens; a second, by Mr. J. Cardot, on mosses; and a third, by Mr. T. Stephani, on liverworts.

In concluding this too brief notice of a most valuable series of monographs, we may congratulate the Belgian Government on its wise liberality in authorising their publication, and the committee of the *Belgica* on the manner in which they have carried out their share of the task.

R. L.

(2) In the department of astronomy we have the discussion of the rates of the chronometers employed and a description of the methods by which time was ascertained during the long confinement of the Antarctic winter. We may say, and it is admitted by the author, M. G. Lecomte, that the astronomical equipment was inadequate. It consisted at the outset of three marine chronometers, a sextant, two artificial horizons, an astronomical telescope, and a theodolite. The size of the telescope is not stated, but it was a relic of the old whaleship, the *Patria*, and was that which had been used by the captain to observe seals when at some distance from the ship. With this instrument, three phenomena of Jupiter's satellites were observed and one occultation. Lunar distances were also observed, but the rates of the chronometers were generally determined from local observations. The accumulated error on return is not clearly stated, but the rates and errors are worked out apparently with great care.

Meteorology naturally claims a large part in the scientific results. The observations were under the charge of M. H. Arctowski, and he has presented the details with very great clearness, and accompanied the whole with many excellent charts, showing graphically the behaviour of the barometer, the hygro-

metrical measurements, and the variations of temperature. The lowest temperature recorded was  $-43^{\circ}.1$  C. ( $-45^{\circ}.6$  F.) on September 8, 1898. The whole result is to exhibit the factors on which the climate depended during the sojourn of the expedition on the shifting ice. The observations do not refer to a particular spot, the ship drifting with the ice some sixteen degrees in longitude and two degrees in latitude. The observation of the clouds and the discussion of the results were entrusted to M. Dobrowolski, who had to encounter many difficulties, due to fog and darkness, which occasion lacunæ in the record. An appendix gives a description, as complete as possible, of a considerable number of cloud systems, divided into three stages of cirrus, clouds at a mean height, and of clouds at low altitudes. The greatest care seems to have been taken in the description of these systems during the twelve months of residence, but here again the expedition might have been better provided with apparatus. The observer had to trust entirely to eye and the compass; no nephoscope was provided, or photographic camera, or means for determining the height of cloud.

The same author discusses the formation of snow and hoar frost, but in this department he appears to have been hampered by the want of instrumental means. He had no microphotographic apparatus, and it has been difficult and sometimes impossible to reproduce the varied structure which he encountered. Hand drawings have been extensively used, and the general result of his work has been to confirm that of modern investigators who have recognised but two types of forms of structure.

An interesting memoir is that of M. Arctowski discussing the optical phenomena witnessed during the expedition. In this section he treats of the deformation of figure of the sun and moon crossing the horizon, illuminations of the sky at twilight, the green ray seen at the moment of the sun's setting, halos, and other phenomena, the peculiarities of which are best studied in polar regions. The author apologises for the popular character of some of his notes, but though greater detail might have been added if a spectroscope had been included in the outfit, these notes afford very interesting reading. The discussion of the auroræ forms a volume by itself, due to the same physicist. Only sixty-two times in thirteen months was this phenomenon witnessed, owing to the facts that the period of minimum auroræ occurred about the time of the expedition, and the region in which the *Belgica* was ice-bound was far from the locality in which auroræ pass through the zenith. Two excellent plates are given in this section.

Oceanography is represented by two memoirs. In the first, M. Arctowski describes the method by which observations were made on the passage across the Pacific to the Straits of Magellan to determine the density of the surface water. Later during the wintering of the expedition samples were drawn from considerable depths below the ice, and examined in the physical laboratory on board. In the second memoir M. Thoulet, professor at the University of

Nancy, gives the results of some experiments made on the density of sea water in the course of an inquiry entrusted to him by the commission in connection with the results derived by M. Arctowski.

W. E. P.

#### ITALIAN CHEMISTRY.

*Trattato di Chimica Inorganica Generale e Applicata all' Industria.* By Dr. E. Molinari. Pp. xxii+693. (Milan: Ulrico Hoepli, 1905.) Price 12.50 lire.

DURING the greater part of last century the progress of science in Italy was retarded by the political troubles of the country; even after the nation had achieved its independence and unity, scientific education was hampered by ecclesiastical controversies and by the poverty of the newly created Government. Taxation has always fallen heavily on the Italian people, and the industry and energy of the north have been taxed unduly owing to the poverty and thriftlessness of the south. In spite of these disadvantages, Italy gave to science in the last century many names which will long be remembered in its history. In particular, the hypothesis of Count Avogadro, enunciated in 1811, forms the basis of the whole of the modern development of chemistry; for nearly fifty years, however, its importance was overlooked, and it was the peculiar merit of another Italian, Cannizzaro, by reviving it, to establish a new epoch in the development of chemical science and to introduce order where all was confused and contradictory.

In the course of the past twenty-five years a school of Italian chemists has arisen the quality of whose work is on a high level of excellence. Side by side with this, an astonishingly rapid development of all branches of the industry of Italy has occurred. The rapidity of the advance may be gauged from a few facts. In the six years 1893-9, the value of the chemical manufactures of Italy exactly doubled itself, increasing from about 1,000,000l. to 2,000,000l. per annum. In the twenty-five years from 1875 to 1900 the value of the raw silk annually produced tripled itself, and that of the woven silk, which in 1890 was 600,000l., rose in 1900 to 4,000,000l. The cotton and wool industries have developed almost as rapidly, and a similar progress is seen in the case of new manufactures, such as that of steel rails, which have only recently been introduced into the country. In some instances Italian manufacturers have begun to compete in foreign markets, and this development bids fair to become still more rapid as Italy converts more and more of her abundant store of water power into electrical energy.

The author of the present treatise, who holds the position of professor of chemistry at the Society for the Encouragement of Arts and Crafts of Milan, has endeavoured in it to initiate a reform in the teaching of chemistry in Italian universities, a reform which has also been recently urged by Profs. Cannizzaro and Ciamician. Hitherto the chemistry taught has been of too academical a character, little attention being given to practical applications. The title of

the present work defines its nature, which is that of a treatise on inorganic chemistry, with especial reference to chemical industry. The commoner elements and their compounds are dealt with in detail, but instead of illustrating the text with time-honoured drawings of lecture apparatus, the actual plant used in the manufacture of these substances is depicted. All the more recent processes of manufacture are described concisely but sufficiently, but the book does not degenerate into a mere treatise of technology. The principal physical and chemical properties of the substances are clearly defined, as well as the relation existing between them; owing to conciseness and to the character of the type employed, a large amount of information is imparted which is not to be found in the usual elementary text-books. A novel feature is that the average market price of each commercial article is stated, whilst statistics are given of the cost of manufacture and profit of many of the more important substances. In many cases the development of an industry is traced through the patents referring to it, for instance, in the case of the manufacture of sulphuric acid and of alkali.

Before undertaking the systematic treatment of the elements, 114 pages are devoted to general chemical theory. It is this part that is most liable to criticism. A portion might very profitably have been omitted. The description, for instance, on pp. 37 to 40, of as many as eight different methods of determining vapour density, serves no useful purpose in a book of this kind, while it is doubtful whether the method of deducing the relationship (pp. 72 to 73) between the osmotic pressure and the freezing and boiling points of dilute solutions will be intelligible to the student in its present form. The historical treatment adopted throughout the work is the cause of a few misstatements which should have been avoided. Why, for instance, revive the story, which has no basis in fact, that Priestley, after languishing in poverty, died of poison? In discussing the history of valency, no mention is made of Frankland and Kolbe, Wurtz and Graham only being referred to. It is, moreover, so far from being the truth (p. 136) that in 1809 Gay-Lussac and Thénard admitted that chlorine was probably an element that even in 1811 they contested Davy's view of its elementary nature. Strangely enough, the part played by Cannizzaro in reviving Avogadro's theory is passed over in silence (p. 33), and the credit given to Gerhardt and Laurent alone.

Dr. Molinari's treatise is especially adapted and is likely to be very serviceable to the student who intends devoting himself to chemical industry; for a similar text-book at an equally low price the English student has long sighed in vain. With a few slight alterations the work could be made equally useful to the engineer. In particular, more space might be given to considering materials of construction, whilst the treatment of alloys is far too brief to be satisfactory, considering the important part which they now play in engineering. Several pages of part i. might well be replaced by a general discussion of the remarkable influence of impurities and of thermal